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ON SCIENTIFIC STUDY OF HIGH-SCHOOL PROBLEMS ¹

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I think there is somewhat less enthusiasm for the science of education among high-school teachers than there is among teachers in the lower schools. High-school problems, we are told, all turn upon a better knowledge of subject-matter, at least all of the problems that concern the individual teacher. Furthermore, the personal equation counts for much in high-school teaching, and the personal equation, the critics of the science of education tell us, is too complex for any of our present methods of scientific manipulation.

Finally, when anyone with sufficient optimism to rise above these objections still insists on advocating a scientific study of high-school matters, he is met with the very pertinent inquiry, Where are examples of such studies to be found? I confess frankly that I should not be able from my present knowledge to produce material which would justify this paper if I were obliged to confine myself to reports of work finished and ready to hand down as a safe basis for final scientific conclusions. There are of course some such studies. I think my colleague, Professor Dearborn, has shown with clearness and finality that high-school grades and college grades are so closely related that the reports of high schools—at least of the class which he studied—are the best possible bases for admission to college. I commend his paper ² to any of you who are in doubt regarding the possibility of a scientific study of high-school problems.

¹ An address delivered November 20, 1909, at the Twenty-second Educational Conference of the Academies and High Schools in Relations with the University of Chicago.

² *Bulletin of the University of Wisconsin*, No. 312: High School Series No. 6. August, 1909.

Reference to this and like studies is, however, not the type of discussion which I intend to present in this paper. I believe that the scientific study of high-school matters will never progress as it should until a large circle of workers are engaged in such studies. High-school problems are indeed complex. There are variable factors which no individual could expect to compass. The only hope is through organized co-operation. Therefore I believe that it will be worth while for us to attempt to formulate with some definiteness the lines along which the study of high-school problems may progress, in the hope that many will become interested in such problems and a body of scientific knowledge grow out of their united efforts.

Let us begin by considering some of the problems related to language teaching. There is a body of very significant scientific material on the general nature of language which I believe that every high-school teacher ought to know. How language originates seems perhaps at first sight a remote question but in this day when we try to understand everything in terms of its origin such general investigations are not unimportant to the teacher of language.

Assume, however, that we do not demand such an introductory study of the nature of language; assume that we come directly to our problem of arranging instruction for high-school pupils. We all recognize at least one distinction in the method of such teaching, namely, the distinction between the natural and the analytical, grammatical method. Is it the business of the French and German teacher to induct the student into the use of the foreign system of expression in the same way that the child learns its mother tongue, through imitation and without emphasis on the structure of the language, or is it the purpose of high-school training to give the child a clear notion of language structure? Do we aim at this higher level of acquisition of language when the student passes out of the vernacular to another tongue to give a new power by leading him to take an entirely different attitude toward language, or are we merely trying to enlarge the scope of his expression, keeping it in kind like his everyday knowledge of his own language? Putting the

matter in terms, not of modern languages, but of the study of Latin and Greek, do we wish the student to acquire the ability to speak these languages, or shall we be contented if the students are able to work out through the use of Latin and Greek declensions and conjugations a better knowledge of the structure of all language and so of their own vernacular?

Given this one sharp contrast, how shall we proceed with our study? How are we to determine the advantages that would be derived from the one type of language teaching or the other? In the first place I wish to emphasize the principle that it is quite possible to begin the study of this question by giving an ordinary examination. Sometimes our specially prepared tests fail to give broad results just because they are special tests. If a student has been trained by the natural method, so that he has a certain facility of interpretation, it would very easily be possible to devise an examination of a grammatical sort which he could not pass at all, and we might thus miss the whole point of the inquiry. Furthermore, a student who had been trained chiefly through a grammatical study of language could very easily be examined to his decided disadvantage by a mere reading test. In general, we should note that if students of the science of education and teachers are to come to any appropriate relations they must begin by reworking ordinary school materials. Let us assume, therefore, as is commonly done, that both types of training, namely, that which would lead to the use of a language and that which would lead to a knowledge of the grammatical structure, are important for the student. Let us assume that a teacher, interested in the two phases of language instruction, sets his examination so as to include both types of material. These two types of material should now be separated in the tabulation of results in such a way as to give a sharp distinction between the two kinds of attainment under discussion. The time will come, I believe, when we shall make use of our examinations in such a way as to test not merely the general ability of the students who take these examinations but to emphasize with some degree of precision the exact type of the student's attainments. Thus, let an examination be set in

Latin or in one of the modern languages, and let the formal parts of all questions dealing with grammatical structure be tabulated on one hand and the parts of questions dealing with ability to use and interpret the language be tabulated on the other hand. Let these two types of knowledge be made the basis of two sets of classifications of students. The study may then be extended to include various schools so that we may see whether the two types of knowledge are exhibited to the same degree of perfection in students taught by different teachers or in students of different ages. Any one of these questions would justify a minute re-examination of an ordinary set of papers. We could ask whether certain schools or certain individual teachers are consciously or unconsciously emphasizing one phase of the work more than the other. I think it is very frequently true that a teacher is more interested in one type of work than in the other. He has, however, no means of comparing his type of influence upon pupils with the type of training given by other teachers who are controlled by other interests. We owe it to ourselves as teachers to make a minute examination of our own tendencies. If a group of ten Latin teachers would make a study of their own interests through the analysis of the examinations passed or not passed by their students, we should have a very valuable scientific study of the teaching of Latin. The material exists in every set of papers. All we need is the reworking of this material by someone interested in drawing clear distinctions.

Another phase of the matter was suggested a moment ago. What is the influence of maturity on language study? Are older children more capable of understanding structural facts, or are they more likely to be interested in interpretations? Which phase of a child's interest progresses more rapidly? What we need for any intelligent understanding of our high-school work in language is a description of the way in which this language function progresses in the normal individual under ordinary conditions. We need what the scientists in other spheres call the natural history of the process. If we could know how an ordinary child would assimilate a new language and

what its effects would be upon his grasp of all grammatical forms, we should then have a basis for remodeling our work as individual teachers and for organizing our general course of study in this field. One of the best studies that was ever made in educational psychology dealt with the natural history of the telegraphic language. We need some such careful study of foreign languages. Let the teacher keep examination papers of older and younger pupils. Let him get sets of papers at different stages of development of the same class and holding to one problem ask persistently what is the relation between knowledge of grammatical structure and knowledge of interpretations. With this sharply defined problem before him, the teacher might make a large contribution to the natural history of language.

I never make a plea for the re-examination of educational experience for scientific purposes without feeling the impulse to comment on the economy which would be effected by accepting this suggestion. Think of the slow progress which we make in our preparation of courses because we do not sift out our materials and state clearly the divergent results which impede our progress. The teachers of classics are very properly proud of the form on which their subjects are now cast. These subjects have been taught by generations and there has finally been reached, often without a clear recognition of how or why, a classification and a grading of the material of instruction such that the needs of the average pupil in the ordinary high school are fairly well met by the accepted course of study. It has taken a great many generations to work out this relatively successful method because no one has gone about the careful analysis of the problem from such a point of view as I attempted to suggest a little time ago. At the present moment there is coming into our schools a vigorous demand for a similar mastery of the modern languages. There is no time for us to work out in long generations the methods of teaching these languages. I think that German and French teachers could in the long run, even without a scientific study, make their subjects quite as valuable for the training of students as Latin and Greek now are.

But we are in a period of educational activity when the demand for the immediate attainment of this end is so strong that the methods adopted by our educators must be much more effective than were the slow methods through which the classics developed. We are driven, therefore, like all of our contemporaries in practical life to the highest possible degree of scientific study for the purposes of economy. We shall never be able to master the problem of teaching modern languages in the time which is allotted to us for working out that problem unless we make a scientific examination of the problem.

A second type of problem which will support my contention that scientific study should be made of high-school problems can be chosen from the sphere of administration. What effect is produced in schools by our various devices of marking and reporting the marks of children? We are under a general necessity of keeping some kind of record of the mental attainments of students. The simplest way of keeping such a record is to get a mathematical expression of the degree of perfection attained by these students. It is a well-known fact in any high-school faculty that the individual differences of the various teachers operate to modify the marking system to such a degree that it is often difficult to compare the reports of different teachers upon the same children. Suppose that we had a thorough-going examination of the whole marking system from the point of view of its relation to the teachers and the students. The problem could be attacked very productively by averaging all the marks of the children in a given school and then comparing the marks of individual teachers with the average marks. Of course there would be a number of elements that would have to come out in the course of the investigation. In the first place, the personality of the teacher might be such as to inspire the students to greater activity than the average activity of the school. Again there would be certain students who would show a high degree of perfection in one kind of subject and a relatively low mark in other subjects. There would appear, however, in spite of these complications, a very wide divergence of practice on the part of different teachers.

The one teacher would mark above his colleagues, the other teacher would mark below his colleagues. If for no other reason, such a study as this should be made in order to make the school intelligent about the significance of its own records. We should also be able to determine the crucial points in any marking system. I think enough examination has been made of this subject to make it clear that the mark of the highest students, the mark of the lowest students, and the average mark of all students are three crucial points in defining the system adopted in any school. If a new teacher could be informed in every school as to the practices in that school with regard to these three crucial points, he could take up very much more intelligently his rating of the students in that school than he can now when he is told that 100 per cent. means perfection, seventy per cent. means passing, and the other grades have some vague reference to school honors and to the conduct of his own courses and the discipline that shall be administered by the faculty to the students.

The second phase of the problem which I suggested a moment ago is the relation of these marks to the work of the students. I think every teacher has some personal attitude toward the marking system. One very frequently hears his colleagues say that it is not a good thing to report to students their standing. Another member of the same corps is heartily in favor of reporting to the students their standings. Sometimes the two practices of reporting and not reporting are practiced side by side in the same school. Sometimes faculty action prevents the one member of the faculty from carrying out his natural tendency to report the marks and makes it a general practice of the school that no marks shall be given out. On the other hand, there are schools where the practice of reporting regularly to the parents is regarded as a great stimulus toward activity on the part of the pupils. It would be very simple to get definite information on the subject of the effect of marks upon the students by making a comparison between successive terms or successive years during which the one practice or the other was adopted and carried out without deviation. Suppose a high

school for a given year should keep an elaborate internal record, but utterly refuse to let the students have any knowledge of this record, and the year following the practice were entirely reversed and the effects examined, we should then be able to substitute for vague general opinions on the part of the teachers with regard to the effect of reporting marks some definite scientific information on that subject. We should have the kind of solution for our problem that is being sought for every practical problem in this day and generation. In departments of agriculture for example, it is no longer a matter of guess whether a certain type of cultivation of a given plant is advantageous or disadvantageous. It is so important that the most economical methods of soil cultivation be adopted that the results of the one method or the other are carefully tabulated and the most productive methods widely adopted. Why should we in our cultivation of an elaborate system of marks fail to apply the same sort of scientific test that is now applied in agriculture?

Another general question which is both administrative and instructorial in its character is the question of the number of hours per week which can advantageously be devoted to a given subject. With the crowding of the modern curriculum, the tendency has developed to give one or two lessons in each of the various subjects which it has seemed advisable to introduce into the school programme. Teachers have, however, protested that it is quite impossible for them to do their work with any degree of efficiency when they meet a class only once or twice a week. The question has frequently been discussed as if it were a general question which can be answered for all subjects in the same terms. On the other hand, the suggestion has frequently been made that the solution of this question is different for different subjects. Thus, it has been stated that for modern languages it is very desirable that classes should meet every day in the week, while for some subjects such as English or history it may be entirely feasible to have one or two class meetings a week and allow the students to do independent work in the interval in order to encourage them to cultivate the type

of concentration which would come from taking up their work without constant supervision. Here, then, are at least two contrasted attitudes—one which emphasizes the importance of continuity of class work and one which would emphasize the growth of independence in student work. How shall we ever solve the problem that is here presented? Again the teacher is a part of the problem. There are undoubtedly some teachers who can teach the subject better when they have the class constantly under their direction. There are other teachers who can stimulate the pupils to do independent work. Under our present scheme these two types of teachers are not sharply differentiated so as to make it possible for the organizer of a high school to distinguish between those teachers who are good recitation masters, who can do the work well in mere routine, and those who do their work in an entirely different way. Suppose that we should introduce in a given high school some election on the part of different teachers of the methods by which they accomplish with their classes a definite result. Suppose we set for two teachers the problem of accomplishing a certain end in history and then allow them to differentiate their methods even to the point of changing the number of hours during which the course should be given. Let the two groups of students thus brought up under different types of class organization be compared with reference to their attainments. Again I wish to say that a general examination might be used for this purpose if its results are properly studied. We might find that one teacher trained the memory of the children well while the other trained the power of independent inference in such a degree as to more than compensate for the lack of special memory drill. I have thus far spoken of history; I am not at all sure that it would appear even in modern languages that the best work is done by drilling the students every day in the week. Whether or not such continuity in class work is desirable certainly has never been determined in any such way as to carry universal conviction. I can think of no more instructive experiment to be worked out in high-school education than the experiment of determining the importance of work in the class and

independent outside work. We have been given certain interesting scientific facts which suggest the possibility that it would be better to allow lapses in class training. Professor James quotes with approval the statement of Exner that we learn to swim in winter and skate in summer. Whether the child learns German on the playground and how to play football in the German class may be solved some day. At all events if it could be shown how the type of training gained in recitation is related to that gained in silent study, we should be in a position to discuss much more intelligently some of the different values in training.

Thus far I have dealt with specific problems. I should not be true to my training as a psychologist if I did not refer to the more general problem of formal discipline and describe it as the great problem of high-school education. We are in the habit of measuring the success of our work by the amount of a given subject which can be assimilated by the students. We have been in the habit of saying that this or that kind of knowledge is valuable, and we have not really meant this or that kind of knowledge, but this or that subject-matter. I believe it is time for us to take an entirely different view of what is meant by the term *kinds of knowledge*. The ability to reason independently, the ability to retain the essentials and neglect the non-essentials, the ability to carry on certain types of inquiry in any subject-matter, all these forms of ability are more important than the ability to reproduce a body of particular information. The meaning of this last contention may be made somewhat clearer by saying that what we need in our examination of the high-school course of study is a complete restatement of the values of these courses in terms of the mental habits which are cultivated as distinguished from the information which is gained. We are just at the beginning of a period of study of the effects of education. We should begin this study by getting some comprehensive notion of the different faculties or different types of mental life which can be regarded as advantageous. Instead of making the general sweeping statements about the value of certain subjects of instruction we ought to

ask how the power to reason can be cultivated, how observation can be improved and widened in scope. In short, we ought to have some classification of our achievements in the educational world which would make it possible for us to talk intelligently about the traits of mental character which have been cultivated. The moment I put the matter in that way I am sure you will all recognize my position on the much-discussed problem of formal discipline to which I am referring. I have put my position somewhat dogmatically, not because I love dogma, but because this is not the place to undertake a full discussion of the matter. I am perfectly clear that one of the most stimulating discussions of our modern education has grown out of the critical remarks of those who have been asserting of late that there is no such thing as formal discipline. It is very interesting to note that the assertions which have been made regarding the non-existence of formal discipline have been based very largely on studies of simple elementary-school subjects. The examination of neatness in arithmetic work has been one of the matters of discussion. The question of whether arithmetic and geography are related or unrelated has been another one of the subjects of discussion. If anything is clear with regard to the problem it is that the final answer to this question will relate not so much to the work of the elementary school as to the work of the high school. There is no doubt at all that the child in the elementary school is very dependent upon the new information which he acquires in any given subject. Furthermore his interests are relatively unsettled and his powers of concentration weak. The result is that the conflicts which exist between the various subjects of instruction in the elementary school are so great that the information which can be gathered with reference to that period of education is of relatively small importance in solving for us the broader general problem of education which presents itself to the high-school teacher. Formal discipline is and always will be a matter of very much greater concern to the high-school teacher than to the teacher in the elementary schools. If this statement is true it follows immediately that we must solve this problem

through an examination of high-school subjects and their inter-relation. Is it true that the work of the Latinist in the high school gives a general form of training which has the value that he places upon it? You and I may have individual opinions about this subject but until these have been justified by a critical, scientific examination, our individual opinions will simply contribute to the general disagreement which now exists. If one asks what are the methods by which this problem can be solved, I think the first answer which must be given is that the problem can never be solved except by a re-examination of the subjects of the high school with reference to the general faculties which they are supposed to train, rather than with reference to the subject-matter itself. When, for example, the teacher of Latin asserts, as he does very vigorously, that his course in Latin trains the child's ability to observe minutely and accurately, we must devise some method of attacking his statement and either supporting him by definite tests or overthrowing him by the same type of definite information. I believe personally that evidence is now at hand in sufficient abundance to justify a conclusion, hence my dogmatic position on the matter a moment ago. If there is anyone who does not accept that conclusion, then in drawing him out I have served my immediate purpose of showing that there are problems to be solved by scientific study of high-school problems.

One final topic which I should like to suggest for scientific investigation is the topic of distribution of subjects in the high school and in the upper grades of the elementary school. Our teaching of physics and chemistry and zoölogy and botany in the high school is in a decidedly experimental stage. It is quite possible for us to find those who advocate a treatment of the physical sciences as suitable material for the early years of the high-school training, while others are disposed to regard the biological sciences as more appropriate material. There are some teachers who advocate the presentation of the sciences in their differentiated form, while others advocate for the high school itself a general introductory course in which physics and biology are not sharply differentiated from each other. Whether

we shall rearrange the elementary course of nature-study so as to prepare for a sharp differentiation in high-school courses or whether we shall carry forward the relatively undifferentiated work into the early years of the secondary course are questions which must be answered through an examination of the ability of the students to compass the various types of matter under discussion. Here as in the case of the modern languages we must take into account the differences in teachers, as well as in pupils. Here as in those earlier subjects discussed we cannot wait for the long process of gradual evolution to perfect methods. We must reach these methods through some forced study of the problem in hand. I know of no better problem with which to bring the elementary and the high school into close contact, than this problem of science teaching, and I know of no finer problem than this with which to illustrate the importance of keeping careful records of results. Let the course be prepared and then record all the results. Modify the course and again record results. Try the experiment with older grades and younger and keep a record. The trouble with us now is that we are trying the variations in the course but are keeping no records. We lose more pedagogical experience every year than would be required, if it were put in permanent form, to make the most valuable book on education ever written. Some day teachers will regard it as a part of their duty to keep records of their results.

These then are some concrete problems which I believe it is proper to urge on every high-school teacher. Some of these problems as I have suggested, and as you know, have been touched upon by isolated students of the science of education. My special purpose here is to urge upon you the possibility of taking up some such problem in connection with your regular work.

Indeed, the whole argument which I have presented is intended to show that the breach between ordinary work and scientific study is very narrow. The idea has been abroad that science and pedagogical experience are opposed to each other, that the scientific man is of necessity impractical and the practi-

cal man is of necessity unscientific. We need to revise this idea. The practical man has much experience which is the indispensable beginning of science. All that is needed in order to make this experience genuine science is some refinement in method of formulating the experience and in recording its results. With regard to the abstractness of much of our science work, that has unquestionably been due to the fact that the science of education has for the most part been in the hands of people who were not in close contact with the actual problems of the classroom. I come back therefore to my original plea for a widespread interest on the part of all high-school teachers in the refinement and definite formulation of their everyday experiences. If we could have a corps of high-school teachers who thought of their problem not merely as a problem of routine instruction of children but as a problem of the rearrangement and reorganization of education, I think we should very soon have in this country a group of specialists who would find this problem of the science of education quite as interesting as the problem undertaken by the specialists in zoölogy or botany or any other subject. It is a curious fact that in academical circles and high-school circles it is eminently respectable to be a student of the lowest forms of animal life and a very doubtful distinction to be a student of education. The specialist who takes up the examination of one of these lower animal forms is regarded as scientific in a high degree, but until very recently there has been little hospitality for the work of the specialist who attempted to study education. It has been thought and often said that education would take care of itself.

Some have asserted that the student of Latin or mathematics or modern language could specialize in these subjects with great propriety, but he could not at the same time have any energy or leisure for the study of education. The result has been that high-school teachers of ability have desired as soon as possible to escape from the hard routine work of teaching children for the purpose of taking up graduate work or for the purpose of accepting minor positions in the university where academic specialization in their various lines is possible. I re-

gard it as important, therefore, that we make perfectly clear the possibilities of treating the Latin in the high school and modern languages in the high school and mathematics and science in the high school in such a way as to make a specialty of the educational problems connected with these sciences and literary subjects. To become a specialist in the organization of these various subjects ought to be the aim of everyone who makes high-school work his special field and I repeat, if we could get the significance of this problem clearly before high-school teachers in this country I think we should contribute to the creation of a profession of high-school teaching. I think we should improve our public-school system if we allowed high-school teachers a certain amount of leisure from their instructional duties in order that they might establish themselves as specialists along these scientific lines which we have been discussing. I think we should have better high schools, classes more economically administered, and young people better trained to go on with higher studies or take up the duties of practical life.